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ABSTRACT

Cut scores, quartile ranking, sample size, and overall classification scheme were studied as personnel selection procedures in two samples. The first was 120 simulated observations of employee scores based on actual selection procedures for applicants for administrative assistant positions. The other sample was composed of test results for 73 applicants for a municipality staff assistant position. It was apparent that overall ranking candidates may result in loss in cost and staff time, since about 28% of applicants were found to be misclassified in this study. Although arbitrary sample sizes did not appear to affect the classification of an individual candidate, cut score variation did result in significant changes in classification. When cut score changes as small as five points were made, reclassification of candidates did occur. Because of vulnerability to litigation, many companies have turned to rank ordering employees and selecting a specific top portion. However, employer vulnerability still exists with regard to methods used in setting cut scores and classifying candidates. Five tables and two figures illustrate various types of classification. (Contains 13 references.) (SLD)

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Personnel Selection Procedures

As a Function of

Sample Size, Cut Scores, and Quartile Ranking

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Paper presented at the Annual Meeting of the American Educational Research Association, April 18-22, San Francisco, CA.

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Personnel classification procedures have been challenged in court cases, particularly in the past ten years (Barrett, Alexander, Anesgart, Doverpike, 1986; Bloom and Killingsworth, 1982; Paetzold, 1991). Many controversies have been initiated based on Federal Legislation (Equal Employment Opportunity Commission, Title V11, of Equal Rights Pay, 1964 and more recently the American Disabilities Act, 1990). Traditionally, the consideration of an appropriate multiple regression equation has been the basis of many primie facie cases of discrimination (Barrett et al, 1986; Bloom & Killingsworth, 1982).

Successful court litigation has occurred based on a variety of factors that contribute to the acceptance or denial of a particular method of analysis. For instance, selection of predictor variables, omission of predictor variables, use of proxy variables, dummy coding, multicollinearity, sample size, method of entry in multiple regression models, cut scores and inequality of subtests (Barrett et. al. 1986, Cohen & Cohen, 1983; Kriska & Milligan, 1982; Mays, 1976; Morris, 1981; Paetzold, 1992 and Rozeboom, 1989).

In order to circumvent litigation many companies have resorted to a classification scheme utilizing cut scores and ranking systems. Often the individual job candidate is rank ordered among their competing cohorts. The actual rank position may then be highly dependent upon the number of applicants as well as final decision for cut scores on application tests. Therefore, the purpose of this paper is to explore the impact of three of these conditions, cut scores, sample size and overall classification scheme.

Cut Scores

When test cut scores are arbitrarily used for input in classification schemes several cautionary procedures should be followed. Standards have been prescribed for setting cut scores by the American Psychological Association (1990). The use of test scores for personnel

classification and selection is outlined by preestablished standards for test publishers. First, cautionary statements concerning the status of misclassification should be reported for score levels at or near the cut off score. Furthermore, job analysis and job classification should be based on actual patterns of predictor scores. The method chosen for setting cut scores should also be presented in the test manual.

If professional judges have been used to set cut scores, the qualifications of the professional judges should be included. These considerations are cited as 'primary' standards for educational and psychological testing. However, the obligation to produce reasonable evidence of fairness in test cut scores rests with the employer.

Scioly (1992) further cites the need of consistency in decisions made. Very often validity and reliability of the test instruments are not linked to the decision scores. Expectancy tables for validity and reliability of test re-test coefficient, r, identity accuracy of classification, particularly for dichotomous variables. A set of measures of expected accuracy frequently used for selection ratios are known as the Taylor-Russell tables. Other aspects of measurements of accuracy in classification are sensitivity, hit rate, and kappa. The main intent is to increase true positives while minimizing false positives and false negatives (see Figure 1). Further investigation of the relationship between reliability and classification accuracy is needed.

The regulations set forth within the American Disabilities Act (ADA) of 1990, further impacted the exposure to liability that employers have in personnel selection procedures. This includes setting cut scores and rank orders. For instance, if the setting of a cut score would penalize a protected group, liability could ensue based on ADA guidelines.

Questions for Investigation

Based on the above considerations this study will explore several areas; a) How does a classification scheme effect individual candidates based on applicant pool?, b) What effect does

sample size have on rank ordering candidates?, c) What effect does changing cut scores have on borderline candidates and lastly, d) If accommodations are needed for a disabled applicant does reclassification occur with the assistance of the accommodation?

Method

Two sample groups were used for this analysis with sample bases of 120 and 73. Data were classified and analyzed as a function of sample size, quartiles and cut scores. A review of the two data sets will follow.

Data Set One

The first sample group consisted of 120 simulated observations of employee scores based on actual selection procedures used for applicants for administrative assistant positions. The actual candidate selection process was based on observed scores from four measures used to test applicants. Cut scores for the English and Math test was 135, a behavioral role playing task recieved a cut score of 20 points, while a personal interview required 10 points minimum score. A typing test required a score of 45 words per minute in order for the candidate to be placed in the final selection pool, although no points were assigned for typing in the combined cut score used for final selection. The final combined cut off score for the selection was then set at 165. Candidates who obtained a score above 165 would be placed in the selection pool.

Upon inspection of Table 1, it should be noted that candidates falling within classification '2', five points above cut off scores, represented approximately 10% of the sample pool across observations. Because the same candidates fell within the 2nd quartile for score ranking they may be rejected, yet they did meet basic criteria for selection via total test scores. Furthermore, candidates classified as '2' represented 5% of the total candidate pool across samples. Based on classification '1st' and '2nd' quartile ranking a total of 15% of a given candidate pool may be rejected unnecessarily.

Data Set Two

A data base from a Central Florida Municipality for the position of Staff Assistant 1 was analyzed. A total of 73 applicants were required to take a two part examination. Part 1 consisted of 44 questions concerning spelling and filing skills and a problem requiring the proper construction of a memo. Part 11 of the exam consisted of an error detection test requiring applicaants to indicate knowledge of proper English to proofread a written memo. A total score of 70 represented minimum requirement for the combination of Part 1 and Part 11 personnel test. A typing test completed with a pass-fail grading required a minimum score of 45 in order for the candidate to be placed on the eligibility list. Additional points are be added to a candidate's total score provided they met minimum standards, five points are added for veterans and .5 points are added per year of seniority.

Provisions are made for candidates requiring testing accommodations. Candidates meeting minimum requirements are then rank ordered within the candidate pool for that test wave. The top candidates are selected based on number of job openings available at a given time. An overview of this data base and analysis is available in Table 2.

In order to investigate the classification for selection a total of four selection categories were formed. Score points analyzed were 125, 130, 135 and over. A score below 125 was classified '0', five points below cut off were classified '1', a total score five points above cut off were classified '2' and all higher scoring candidates were classified as '3'. Random sampling of candidates was completed through the Ranuni sampling procedure on SAS computer package. Sample sizes and iterations for random selection were varied. For instance, iterations varied in frequency from 50 samples of 20, 25 samples of 40, 15 samples of 60, 10 samples of 100 and 10 samples of 120 were computed. A total count of candidate selection per each cycle of random frequencies and iterations was obtained (see Table 3).

One difference in programming for classification for this data base is that an, 'or', statement was used for selection of candidates into categories. That is they must meet minimum requirements on Part 1, 'or' Part 11 in order to be classified in category 1 or 2. Therefore, a candidate might fall within five points below or above cut off on one test, but be classified as a '2'. Similarly, a candidate falling five points below cutoff would be classified as a '1'.

In addition to classification of candidates by cut score, candidates were classified into 25% 50% and 75% percentile ranges for rank ordering based on total score. A Fischer's exact statistical test was completed on a frequency chart of the top quartile candidates for the five sample size iterations. Results indicated non-significant findings for rank-order regardless of sample size.

Classification Scheme

The classification scheme placed candidates within five categories a) a rating of '0' was assigned to those candidates falling more than five points below cutoff b) a rating of '1' indicated a total score on one of the two part test falling within five points below cutoff score, c) '2' indicated candidates that fell within five points above cutoff standards d) '3' indicated candidates over the five point range of minimum standards, and e) '4' classification indicated candidates falling above all other classifications.

Rank-Ordered Quartiles

In order to assess the appropriateness of rank ordering individuals for selection, a subset sample of the 120 applicants was extrapolated (see Figure 1). Inspection of the frequency table indicated that 28% of the applicant pool were classified in the 3rd quartile, yet met all minimum entry requirements by test scores. If this is a usual occurrence with applicant pools when rank-ordering is used for selection, close to one-third of qualified applicants would be

falsely rejected. The 'real world' impact of rejecting nearly 28% qualified personnel cannot be ignored. Costs involved for test time, and staffing of assessment centers are substantial. Redundant expenses for recruitment, file review, and evaluation of a candidate pool would occur.

Sample Size and Frequency

To assess this matter another way, the upper quartile sample for the candidates within the 120 sample size group were extrapolated from the others (see Table 3). A Fischer's exact test was computed on frequencies across sample sizes and reiterations, non-significance was indicated. Frequency in selection based on random sample size did not appear to be significantly different regardless of sample size.

Two Criteria Bias

Classification scheme for category 1 and 2 were also further analyzed. Table 4 depicts the individual candidates within this category for sample size 20, 50 iterations. Inspection of the total score values indicates candidates who may have more than sufficiently passed one test measure, but fell one or

two points below cutoff on a second test. The typing test scores most frequently resulted within a lower ranking for merely one or two points. Given the nature of test anxiety and unfamiliarity with a given typewriter equipment, it would appear that another grouping of candidates may be erroneously classified in the non-selection category; thus driving the false positive rate higher. If one inspects category '1' section for candidate id #2894 (see Table 4) one can see a vivid example of this problem. The candidate has more than sufficient basic skills for mental processing of tasks, yet missed classification levels by simply three points on a typing test. The standard error of measurement may account for this discrepancy and reclassification of that candidate may be warranted.

Candidate Test Scores and Accommodations

In order to provide an in-depth look at the overall classification scheme for each category Table 5 is provided. Classification number and frequency of observations are included for each sample size and iterations. Similar classification of candidates was found across sample sizes. One candidate who did require accommodations (candidate # 2937) for test admission resulted in a total score of 84 and typing test of 49 classified as '2'. Whether or not the administration of a large print test differentiated a passing grade would be difficult to obtain, however, given the accommodation, the candidate did fall within five points above minimum standards.

Cut Score Variation

A final analysis was conducted by lowering cut scores for both the written test and typing test. A reclassification of class frequencies was computed on ten iterations of 120 sample size for the Data Two group. A plot of both cut score levels was computed (see Figure 2). The upper right quadrant signifies true positives. Each letter value has a numerical value relative to letter placement in the alphabet. Inspection of plots 'a' and 'b' clearly depict the differences in classifications for borderline applicants.

For many standardized commercial personnel tests, five points can result in large discrepancies between true positives and false negatives. For appropriate personnel placement perhaps a range of acceptable values should be utilized to minimize false classifications. Obviously, the ultimate goal of any testing program would be to reduce false negatives and increase true positives. Perhaps utilizing a range of cut scores as indicated by the standard error of measurement for that test, would be helpful. In addition to maximizing human resource potential, this method of setting cut scores could save an individual company significant funds in reduced recruitment efforts and staff time to conduct candidate evaluations.

Summary

In summary two data samples were evaluated as a basis of classification schemes, quartile ranking and cut score differences. It was clearly demonstrated that 'overall' ranking candidates may result in substantial lose in cost and staff time given the 28% example of misclassified candidates found within this study. Although arbitrary sample sizes did not appear to effect classification of an individual candidate, cut scores variation did result in significant changes in classification. When cut score changes as small as five-points were made, reclassification of candidates did occur.

Future investigations should explore differences in subtest scoring, measurement significance and certainly individual test standard error of measurement. Research literature indicates a high degree of litigation cases concerning the use of multiple-regression techniques for personnel selection. In part, due to the vulnerability of litigation, many companies have turned to rank ordering employees and selecting a specific top ratio of candidates. However, employer vulnerability still exists in regard to methods used in setting cut scores and applicant classification.

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Table 1
Estimates of Classification Quartiles Based on Sample Size

Sample Size	N	Classification		4th	3rd	2nd	1st	Total
50	20	0	Frequency	113	416	0	0	529
			Percent	11.3	41.60	0.0	0.0	52.90
50	20	1	Frequency	0	19	47	4	70
			Percent	0.00	1.9	4.7	.40	7.0
50	20	2	Frequency	0	13	96	7	116
			Percent	0.0	0.00	9.60	70	11.60
50	20	3	Frequency	0	0	33	252	285
			Percent	0.00	0.90	3.50	25.20	28.50
	TOTAL		Frequency	113	448	176	263	1000
			Percent	11.30	4.80	17.60	26.30	
25	40	0	Frequency	120	408	0	0	528
			Percent	12.0	40.80	0.00	0.00	52.80
25	40	1	Frequency	0	18	56	0	74
			Percent	0.0	1.80	5.60	0.0	7.40
25	40	2	Frequency	0	0	105	18	123
			Percent	0.0	0.0	10.50	1.8	12.30
25	40	3	Frequency	0	0	0	275	275
			Percent	0.00	0.00	0.00	27.5	27.50
	TOTAL		Frequency	120	426	161	293	1000
			Percent	12.0	42.60	16.10	29.30	
15	60	0	Frequency	196	258	0	0	454
			Percent	21.76	28.67	0.00	0.00	50.44
15	60	1	Frequency	0	5	49	0	54
			Percent	0.00	0.56	5.44	0.00	6.0
15	60	2	Frequency	0	0	111	0	111
			Percent	0.00	0.00	11.1	0.00	11.1
15	60	3	Frequency	0	0	0	281	281
			Percent	0.00	0.00	0.00	28.1	31.22
	TOTAL		Frequency	196	263	160	281	900
			Percent	21.76	29.72	17.78	31.22	
10	100	0	Frequency	196	413	0	0	519
			Percent	10.60	41.30	0.00	0.00	51.90
10	100	1	Frequency	0	11	78	0	89
			Percent	0.00	1.10	7.80	0.00	8.90
10	100	2	Frequency	0	0	100	5	105
			Percent	0.00	0.00	10.00	0.50	10.56
10	100	3	Frequency	0	0	0	287	287
			Percent	0.00	0.00	0.00	28.76	28.70
	TOTAL		Frequency	106	424	178	292	1000
			Percent	10.60	42.40	17.80	29.20	
10	120	0	Frequency	164	455	0	0	619
			Percent	13.67	37.92	0.00	0.00	51.58
10	120	1	Frequency	0	13	78	0	91
			Percent	0.00	1.08	6.50	0.00	7.58
10	120	2	Frequency	0	0	120	0	120
			Percent	0.00	0.00	10.00	0.00	10.00
10	120	3	Frequency	0	0	0	370	370
			Percent	0.00	0.00	0.00	30.83	30.83
	TOTAL			164	468	198	370	1200
				13.67	39.00	16.50	30.83	

Table 2
Estimates of Candidates Selection Based on Sample Size

Sample Size	N	Classification		0	1	2	3	Total
50	20	0	Frequency	78	0	0	0	78
			Percent	7.80	0.00	0.00	0.00	7.8
50	20	1	Frequency	111	26	0	0	137
			Percent	11.10	2.60	0.00	0.00	13.70
50	20	2	Frequency	29	204	8	0	241
			Percent	2.9	20.40	.80	0.00	2.41
50	20	3	Frequency	0	29	264	4	297
			Percent	0.00	2.90	26.4	.40	29.70
50	20	4	Frequency	0	0	10	237	247
			Percent	0.00	0.00	1.0	2.70	24.70
TOTAL			Frequency	218	259	282	241	1000
			Percent	21.80	25.90	28.20	24.10	
25	40	0	Frequency	94	0	0	0	94
			Percent	9.40	0.00	0.00	0.00	9.40
25	40	1	Frequency	125	26	0	0	151
			Percent	12.5	2.6	0.00	0.00	15.10
25	40	2	Frequency	0	217	0	0	217
			Percent	0.00	21.7	0.00	0.00	21.70
25	40	3	Frequency	0	15	268	0	283
			Percent	0.00	1.50	26.80	0.00	28.30
25	40	4	Frequency	0	0	0	255	255
			Percent	0.00	0.00	0.00	25.5	25.50
TOTAL			Frequency	219	258	268	255	1000
			Percent	21.90	25.80	26.80	25.50	
15	60	0	Frequency	9	0	0	0	91
			Percent	10.11	0.00	0.00	0.00	10.11
15	60	1	Frequency	113	0	0	0	133
			Percent	12.56	0.00	0.00	0.00	12.56
15	60	2	Frequency	0	210	0	0	210
			Percent	0.00	23.33	0.00	0.00	23.33
15	60	3	Frequency	0	0	243	0	243
			Percent	0.00	0.00	27.00	0.00	27.00
15	60	4	Frequency	0	0	0	243	243
			Percent	0.00	0.00	0.00	27.00	27.00
TOTAL			Frequency	204	210	243	243	900
			Percent	22.07	23.33	27.00	27.00	
10	100	0	Frequency	87	0	0	0	87
			Percent	8.70	0.00	0.00	0.00	8.70
10	100	1	Frequency	129	0	0	0	129
			Percent	12.90	0.00	0.00	0.00	12.90
10	100	2	Frequency	0	223	0	0	223
			Percent	0.00	22.30	0.00	0.00	22.30
10	100	3	Frequency	0	0	285	0	285
			Percent	0.00	0.00	28.5	0.00	28.5
10	100	4	Frequency	0	0	0	276	276
			Percent	0.00	0.00	0.00	27.60	27.60
TOTAL			Frequency	216	223	285	276	1000
			Percent	21.6	22.3	28.5	27.6	
10	120	0	Frequency	87	0	0	0	87
			Percent	8.70	0.00	0.00	0.00	8.70
10	120	1	Frequency	129	0	0	0	129
			Percent	12.90	0.00	0.00	0.00	12.90
10	120	2	Frequency	0	223	0	0	223
			Percent	0.00	22.30	.00	0.00	22.30
10	120	3	Frequency	0	0	285	0	285
			Percent	0.00	0.00	28.5	0.00	28.5
10	120	4	Frequency	0	0	0	276	276
			Percent	0.00	0.00	0.00	27.60	27.60
TOTAL				216	223	285	276	1000
				21.6	22.3	28.5	27.6	

Table 3

Upper Quartile Ratings For Data Set Two

	A	B	C	D	E
	25/40	50/20	15/60	10/100	10/120
2908	10	16	5	14	14
2906	6	7	10	15	11
2913	9	9	145	8	12
2884	10	10	13	14	15
2852	13	11	12	9	18
2905	21	7	14	14	23
2914	8	10	13	12	13
2870	15	19	12	17	8
2861	16	10	11	11	12
2939	11	15	7	17	13
2912	13	9	11	11	11
2869	11	15	10	10	11
2907	14	9	12	7	13
2893	11	8	14	12	9
2973	9	14	13	13	9
2915	12	13	13	12	21
2934	10	9	12	18	13
2895	12	12	9	8	9
2921	14	15	6	13	19
2868	13	5	9	11	13
2902	7	16	9	23	18
287	10	8	14	7	12

Table 4

Estimate of Frequency on Non-Selection Based on Five Points Below Cut-off Score.

Category 1

ITERATIONS	N	ID	FREQUENCY	TOTAL TEST	TYPING
50	20	2856	15	74	45*
50	20	2917	11	77	42
50	20	2889	8	78	43
50	20	2903	12	76	41
50	20	2922	11	89	43
50	20	2885	13	84	45*
50	20	2924	16	84	41
50	20	2866	12	79	45*
50	20	2894	13	96	42
50	20	2916	8	67	19
50	20	2851	8	92	45*
TOTAL					137

Category 2

ITERATIONS	N	ID	FREQUENCY	TOTAL TEST	TYPING
50	20	2854	13	83	47
50	20	2857	3	81	49
50	20	2865	16	80	46
50	20	2901	13	87	49
50	20	2872	11	71	46
50	20	2883	19	83	49
50	20	2920	17	80	46
50	20	2867	14	93	46
50	20	2931	13	91	47
50	20	2892	13	91	46
50	20	2919	12	81	47
50	20	2864	13	73	37
50	20	2932	10	71	27
50	20	2876	13	86	50
50	20	2899	14	74	65
50	20	2937*	16	84	49
50	20	2877	14	71	24
50	20	2878	10	74	19
50	20	2879	7	92	48
TOTAL					241

Table 5
Summary of Classifications and Frequencies By Sample Size

Iterations N	50 20	50 20	25 14	25 14	15 60	15 60	10 100	10 500	10 120	10 120
ID#	CLASS	OBS	CLASS	OBS	CLASS	OBS	CLASS	OBS	CLASS	OBS
2908	4	16	4	10	4	5	4	14	4	13
2854	2	13	2	9	2	11	2	9	2	16
2906	4	7	4	6	4	10	4	15	4	14
2913	4	9	4	9	4	14	4	8	4	13
2880	0	13	0	15	0	13	0	14	0	13
2856	1	15	1	10	1	6	1	14	0	1
2857	2	3	2	8	2	14	2	16	2	12
2917	1	11	1	14	2	15	1	13	1	23
2884	4	10	4	10	4	13	4	14	4	13
2852	4	11	4	13	4	12	4	9	4	11
2863	3	15	3	15	3	3	3	12	3	8
2905	4	7	4	21	4	14	4	14	4	17
2865	2	16	3	12	2	13	2	6	2	18
2889	1	8	1	8	1	9	1	15	1	13
2933	3	8	3	12	3	7	3	10	3	16
2862	0	13	0	7	0	14	0	17	0	8
2930	3	15	3	12	3	10	3	10	3	10
2914	4	10	4	8	1	13	4	12	4	13
2870	4	9	4	15	4	12	4	17	4	11
2986	3	12	3	3	3	10	3	16	3	17
2901	1	13	2	19	2	14	2	11	2	20
2861	4	10	4	16	4	11	4	11	4	14
2910	3	15	3	11	3	18	3	7	3	15
2872	2	11	2	11	2	6	2	14	2	16
2883	2	19	2	11	2	9	2	7	2	14
2920	2	9	2	15	3	7	2	15	2	18
2938	0	9	2	14	0	14	0	10	0	10
2871	3	9	0	21	3	6	3	17	3	22
2903	1	12	1	8	1	12	1	8	1	14
2939	4	15	4	11	4	4	4	17	4	9
2922	1	11	1	16	1	11	1	9	1	8
2867	2	14	2	11	2	8	2	7	2	11
2927	3	14	3	11	3	13	3	12	3	8
2912	4	9	4	13	4	11	4	11	4	18
2931	2	13	2	13	2	9	2	12	2	12
2885	1	13	1	8	1	7	1	8	1	17
2897	0	17	0	14	0	9	0	11	0	9
2892	2	13	3	13	2	6	2	14	2	11
2869	4	15	4	11	4	10	4	10	4	18
2898	3	19	3	9	3	8	3	14	3	13
2907	4	9	4	14	4	12	4	7	4	15
2886	3	14	3	14	3	9	3	10	3	16
2919	2	12	2	11	2	11	2	14	2	11
2893	4	8	4	11	4	14	4	12	4	20
2873	4	14	4	9	4	13	4	13	4	8
2915	4	13	4	12	4	13	4	12	4	19
2924	1	16	1	23	1	10	1	7	1	14
2858	3	10	3	17	3	14	3	14	3	15
2918	3	10	3	7	3	9	3	10	3	14
2934	4	9	4	10	4	12	4	18	4	12
2866	12	1	1	13	1	9	1	10	1	7
2895	4	12	4	12	4	9	4	8	4	17
2921	4	15	4	14	4	6	4	13	4	14
2894	1	13	1	12	1	13	1	12	1	11
2916	1	8	1	10	1	5	1	9	1	14
2935	3	10	3	10	3	7	3	10	3	5
2864	2	13	2	9	2	18	2	13	2	15
2900	3	15	3	12	3	10	3	14	3	12
2932	2	10	2	9	2	14	2	15	2	18
2868	4	5	4	13	4	9	4	11	4	14
2851	1	8	1	14	1	9	1	10	1	22
2928	3	12	3	10	3	10	3	11	3	15
2929	3	8	3	15	3	8	3	9	3	21
2876	2	13	3	8	2	11	2	11	3	29
2899	2	14	2	9	2	12	2	14	2	14
2937	2	16	2	12	2	13	2	9	2	16
2923	3	19	3	12	3	12	3	15	3	19
2925	3	12	3	16	3	9	3	11	3	15
2874	3	16	3	14	3	14	3	14	3	14
2902	4	16	4	7	4	9	4	23	4	11
2877	2	14	1	13	2	15	2	16	3	12
2887	3	8	3	9	3	4	3	8	4	12
2878	2	10	2	12	2	9	2	8	2	14
2926	2	13	3	10	3	12	2	17	3	13
2875	4	8	4	1	4	14	4	7	4	11
2879	2	7	2	9	2	10	2	12	2	22
2891	0	5	0	10	0	9	0	8	1	15
2882	3	9	3	13	3	13	3	9	3	15
2881	0	9	0	12	0	9	0	13	1	19
2859	3	16	3	10	3	8	4	10	3	21
2853	0	12	0	15	0	23	0	14	0	1
2855	3	12	3	11	3	15	3	9	3	17
2888	1	10	1	15	1	7	1	14	1	23
2859	3	6	3	12	3	13	3	16	3	6

10 SAMPLES OF SAMPLE SIZE 120

TABLE OF CLASS BY RANK TOTAL

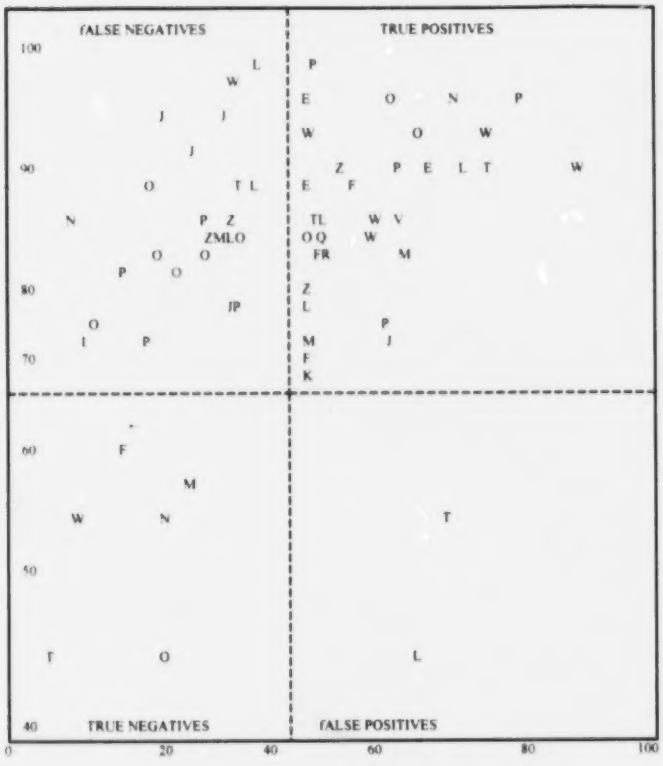
RANK TOTAL FOR VARIABLE CLASS

FREQUENCY PERCENT ROW PER CENT COL PER CENT	0	1	2	3	TOTAL
0	84 7 00 100 00 31 70				84 7 00
1	181 15 08 100 00 68 30				181 15 08
2		291 24 25 100 00 100 00			291 24 25
3			339 28 25 100 00 100 00		339 28 25
4				305 25 42 100 00 100 00	305 25 42
TOTAL	265 22 08	291 24 25	339 28 25	305 25 42	100 00 100 00

FIGURE 1

CUT SCORES - WRITTEN TEST 70 TYPING 45

PLOT OF SCORES



CUT SCORES- WRITTEN TEST 65 TYPEING TEST 40

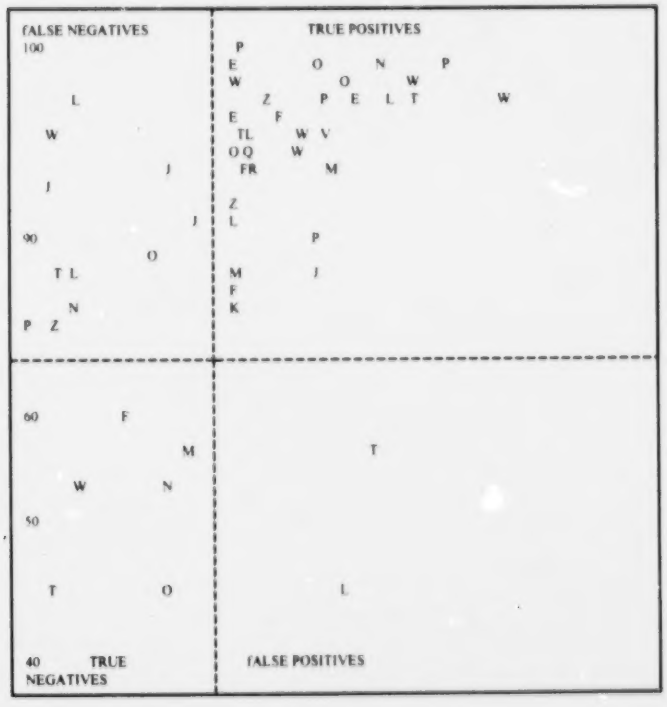


FIGURE 3